DATASHEET

Four Output Differential Buffer for PCIe Gen 1, Gen 2 and QPI ICS9DB423B

Recommended Application:

DB400Q compatible part with PCIe Gen1, Gen 2 and QPI support

General Description:

The ICS9DB423 is compatible with the Intel DB400Q Differential Buffer Specification. This buffer provides 4 PCI-Express SRC or 4 QPI clocks. The ICS9DB423 is driven by a differential output pair from a CK410B+ or CK509B main clock generator.

Key Specifications

- Output cycle-cycle jitter < 50ps.
- Output to Output skew <50ps
- Phase jitter: PCIe Gen1 < 86ps peak to peak
- Phase jitter: PCIe Gen2 < 3.0/3.1ps rms
- Phase jitter: QPI < 0.5ps rms
- RoHS compliant packaging

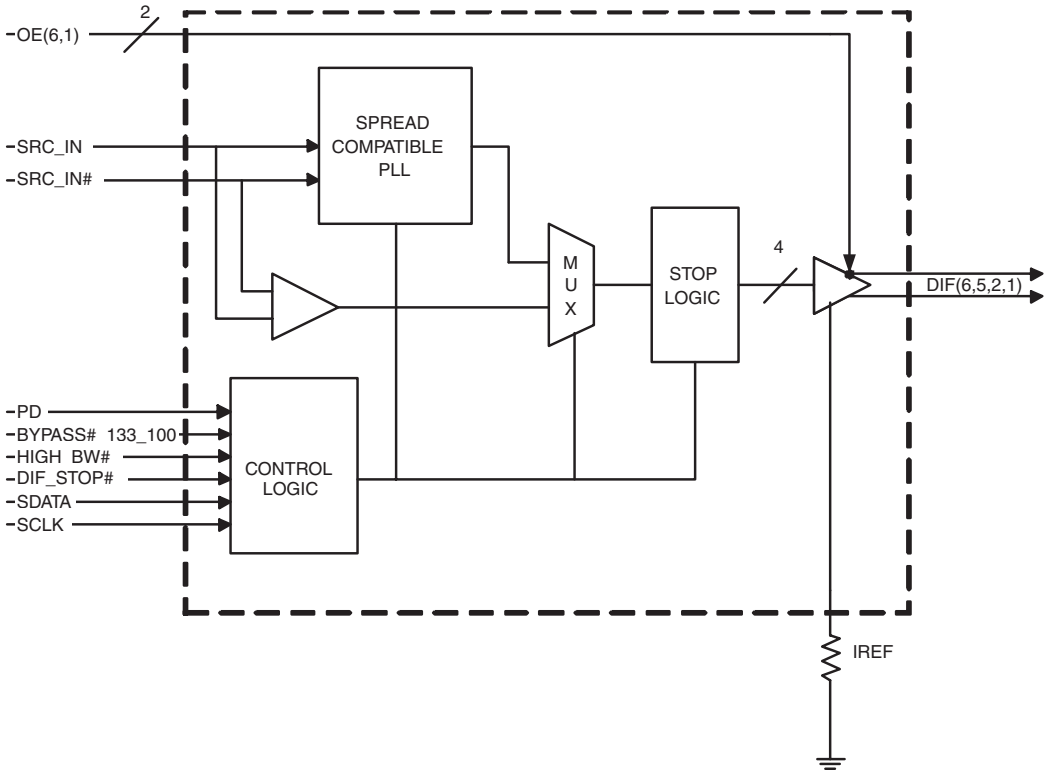
Features/Benefits

- Spread spectrum modulation tolerant, 0 to -0.5% down spread and +/- 0.25% center spread.
- Supports undriven differential outputs in Power Down and DIF_STOP# modes for power management.

Output Features

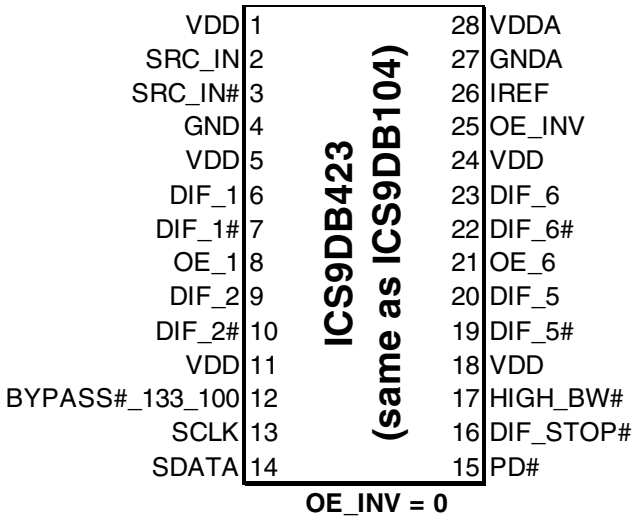
- 4 - 0.7V current-mode differential output pairs
- Supports zero delay buffer mode and fanout mode
- Bandwidth programming available
- 50-133 MHz operation in PLL mode
- 33-400 MHz operation in Bypass mode

Funtional Block Diagram

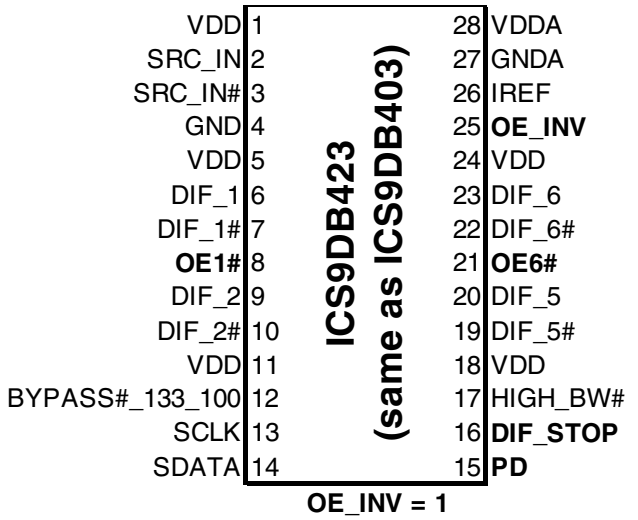


Note: Polarities shown for OE_INV = 0.

Pin Configuration



OE_INV = 0



OE_INV = 1

28-pin SSOP & TSSOP

Polarity Inversion Pin List Table

Pins	OE_INV	
	0	1
8	OE_1	OE1#
15	PD#	PD
16	DIF_STOP#	DIF_STOP
21	OE_6	OE6#

Frequency Selection

BYPASS#_133_100	Voltage	MODE
Low	<0.8V	Bypass
Mid	1.2<Vin<1.8V	QPI 133MHz
High	Vin > 2.0V	PCIe 100MHz

Power Groups

Pin Number		Description
VDD	GND	
1	4	SRC_IN/SRC_IN#
5,11,18, 24	4	DIF(1,2,5,6)
N/A	27	IREF
28	27	Analog VDD & GND for PLL core

Bypass Readback Table

BYPASS#_133_100	Byte0, bit 3	Byte 0 bit 1
Low	0	0
Mid	1	0
High	0	1

Pin Description for OE_INV = 0

PIN #	PIN NAME	PIN TYPE	DESCRIPTION
1	VDD	PWR	Power supply, nominal 3.3V
2	SRC_IN	IN	0.7 V Differential SRC TRUE input
3	SRC_IN#	IN	0.7 V Differential SRC COMPLEMENTARY input
4	GND	PWR	Ground pin.
5	VDD	PWR	Power supply, nominal 3.3V
6	DIF_1	OUT	0.7V differential true clock output
7	DIF_1#	OUT	0.7V differential Complementary clock output
8	OE_1	IN	Active high input for enabling output 1. 0 = tri-state outputs, 1= enable outputs
9	DIF_2	OUT	0.7V differential true clock output
10	DIF_2#	OUT	0.7V differential Complementary clock output
11	VDD	PWR	Power supply, nominal 3.3V
12	BYPASS#_133_100	IN	Input to select Bypass(fan-out), QPI PLL (133MHz) or PCIe PLL (100MHz) mode 0 = Bypass mode, M= QPI, 1= PCIe PLL mode
13	SCLK	IN	Clock pin of SMBus circuitry, 5V tolerant.
14	SDATA	I/O	Data pin for SMBus circuitry, 3.3V tolerant.
15	PD#	IN	Asynchronous active low input pin used to power down the device. The internal clocks are disabled and the VCO and the crystal are stopped.
16	DIF_STOP#	IN	Active low input to stop differential output clocks.
17	HIGH_BW#	IN	3.3V input for selecting PLL Band Width 0 = High, 1= Low
18	VDD	PWR	Power supply, nominal 3.3V
19	DIF_5#	OUT	0.7V differential Complementary clock output
20	DIF_5	OUT	0.7V differential true clock output
21	OE_6	IN	Active high input for enabling output 6. 0 = tri-state outputs, 1= enable outputs
22	DIF_6#	OUT	0.7V differential Complementary clock output
23	DIF_6	OUT	0.7V differential true clock output
24	VDD	PWR	Power supply, nominal 3.3V
25	OE_INV	IN	This latched input selects the polarity of the OE pins. 0 = OE pins active high, 1 = OE pins active low (OE#)
26	IREF	OUT	This pin establishes the reference current for the differential current-mode output pairs. This pin requires a fixed precision resistor tied to ground in order to establish the appropriate current. 475 ohms is the standard value.
27	GNDA	PWR	Ground pin for the PLL core.
28	VDDA	PWR	3.3V power for the PLL core.

Pin Description for OE_INV = 1

PIN #	PIN NAME	PIN TYPE	DESCRIPTION
1	VDD	PWR	Power supply, nominal 3.3V
2	SRC_IN	IN	0.7 V Differential SRC TRUE input
3	SRC_IN#	IN	0.7 V Differential SRC COMPLEMENTARY input
4	GND	PWR	Ground pin.
5	VDD	PWR	Power supply, nominal 3.3V
6	DIF_1	OUT	0.7V differential true clock output
7	DIF_1#	OUT	0.7V differential Complementary clock output
8	OE1#	IN	Active low input for enabling DIF pair 1. 1 = tri-state outputs, 0 = enable outputs
9	DIF_2	OUT	0.7V differential true clock output
10	DIF_2#	OUT	0.7V differential Complementary clock output
11	VDD	PWR	Power supply, nominal 3.3V
12	BYPASS#_133_100	IN	Input to select Bypass(fan-out), QPI PLL (133MHz) or PCIe PLL (100MHz) mode 0 = Bypass mode, M= QPI, 1= PCIe PLL mode
13	SCLK	IN	Clock pin of SMBus circuitry, 5V tolerant.
14	SDATA	I/O	Data pin for SMBus circuitry, 3.3V tolerant.
15	PD	IN	Asynchronous active high input pin used to power down the device. The internal clocks are disabled and the VCO is stopped.
16	DIF_STOP	IN	Active High input to stop differential output clocks.
17	HIGH_BW#	IN	3.3V input for selecting PLL Band Width 0 = High, 1= Low
18	VDD	PWR	Power supply, nominal 3.3V
19	DIF_5#	OUT	0.7V differential Complementary clock output
20	DIF_5	OUT	0.7V differential true clock output
21	OE6#	IN	Active low input for enabling DIF pair 6. 1 = tri-state outputs, 0 = enable outputs
22	DIF_6#	OUT	0.7V differential Complementary clock output
23	DIF_6	OUT	0.7V differential true clock output
24	VDD	PWR	Power supply, nominal 3.3V
25	OE_INV	IN	This latched input selects the polarity of the OE pins. 0 = OE pins active high, 1 = OE pins active low (OE#)
26	IREF	OUT	This pin establishes the reference current for the differential current-mode output pairs. This pin requires a fixed precision resistor tied to ground in order to establish the appropriate current. 475 ohms is the standard value.
27	GNDA	PWR	Ground pin for the PLL core.
28	VDDA	PWR	3.3V power for the PLL core.

Absolute Max

Symbol	Parameter	Min	Max	Units
VDD_A	3.3V Core Supply Voltage		4.6	V
VDD_In	3.3V Logic Supply Voltage		4.6	V
V_{IL}	Input Low Voltage	GND-0.5		V
V_{IH}	Input High Voltage		V_{DD}+0.5V	V
Ts	Storage Temperature	-65	150	°C
Tambient	Ambient Operating Temp	0	70	°C
Tcase	Case Temperature		115	°C
ESD prot	Input ESD protection human body model	2000		V

Electrical Characteristics - Input/Supply/Common Output Parameters

T_A = 0 - 70°C; Supply Voltage V_{DD} = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Input High Voltage	V_{IH}	3.3 V +/-5%	2		V_{DD} + 0.3	V	1
Input Low Voltage	V_{IL}	3.3 V +/-5%	GND - 0.3		0.8	V	1
Input High Current	I_{IH}	V_{IN} = V_{DD}	-5		5	uA	1
Input Low Current	I_{IL1}	V_{IN} = 0 V; Inputs with no pull-up resistors	-5			uA	1
	I_{IL2}	V_{IN} = 0 V; Inputs with pull-up resistors	-200			uA	1
Operating Supply Current	$I_{DD3.3OP}$	Full Active, C_L = Full load;			200	mA	1
Powerdown Current	$I_{DD3.3PD}$	all diff pairs driven			60	mA	1
		all differential pairs tri-stated			6	mA	1
Input Frequency	F_{iPLL}	PCIe Mode (Bypass/133/100= 1)	50	100.00	110	MHz	1
	F_{iPLL}	QPI Mode (Bypass/133/100= M)	67	133.33	140	MHz	1
	$F_{iBYPASS}$	Bypass Mode (Bypass/133/100= 0)	33		400	MHz	1
Pin Inductance	L_{pin}				7	nH	1
Capacitance	C_{IN}	Logic Inputs, except SRC_IN	1.5		5	pF	1
	C_{INSRC_IN}	SRC_IN differential clock inputs	1.5		2.7	pF	1,4
	C_{OUT}	Output pin capacitance			6	pF	1
PLL Bandwidth	BW	-3dB point in High BW Mode	2	3	4	MHz	1
		-3dB point in Low BW Mode	0.7	1	1.4	MHz	1
PLL Jitter Peaking	t_{JPEAK}	Peak Pass band Gain		1.5	2	dB	1
Clk Stabilization	T_{STAB}	From V_{DD} Power-Up and after input clock stabilization or de-assertion of PD# to 1st clock			1	ms	1,2
Input SS Modulation Frequency	f_{MODIN}	Allowable Frequency (Triangular Modulation)	30		33	kHz	1
OE# Latency	$t_{LATOE\#}$	DIF start after OE# assertion DIF stop after OE# deassertion	1		3	cycles	1,3
Tdrive_DIF_Stop#	t_{DRVSTP}	DIF output enable after DIF_Stop# de-assertion			10	ns	1,3
Tdrive_PD#	t_{DRVPD}	DIF output enable after PD# de-assertion			300	us	1,3
Tfall	t_F	Fall time of PD# and DIF_Stop#			5	ns	1
Trise	t_R	Rise time of PD# and DIF_Stop#			5	ns	2
SMBus Voltage	V_{MAX}	Maximum input voltage			5.5	V	1
Low-level Output Voltage	V_{OL}	@ I_{PULLUP}			0.4	V	1
Current sinking at V_{OL}	I_{PULLUP}		4			mA	1
SCLK/SDATA Clock/Data Rise Time	t_{RSMB}	(Max VIL - 0.15) to (Min VIH + 0.15)			1000	ns	1
SCLK/SDATA Clock/Data Fall Time	t_{FSMB}	(Min VIH + 0.15) to (Max VIL - 0.15)			300	ns	1
SMBus Operating Frequency	f_{MAXSMB}	Maximum SMBus operating frequency			100	kHz	1,5

[1]Guaranteed by design and characterization, not 100% tested in production.

[2]See timing diagrams for timing requirements.

[3]Time from deassertion until outputs are >200 mV

[4]SRC_IN input

[5]The differential input clock must be running for the SMBus to be active

Electrical Characteristics - Clock Input Parameters

T_A = 0 - 70°C; Supply Voltage V_{DD} = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Input High Voltage - DIF_IN	V_{IHDIF}	Differential inputs (single-ended measurement)	600	800	1150	mV	1
Input Low Voltage - DIF_IN	V_{ILDIF}	Differential inputs (single-ended measurement)	V_{SS} - 300	0	300	mV	1
Input Common Mode Voltage - DIF_IN	V_{COM}	Common Mode Input Voltage	300		1000	mV	1
Input Amplitude - DIF_IN	V_{SWING}	Peak to Peak value	300		1450	mV	1
Input Slew Rate - DIF_IN	dv/dt	Measured differentially	0.4		8	V/ns	1,2
Input Leakage Current	I_{IN}	$V_{IN} = V_{DD}$, V_{IN} = GND	-5		5	uA	1
Input Duty Cycle	d_{tin}	Measurement from differential wavefrom	45		55	%	1
Input Jitter - Cycle to Cycle	J_{DIFIn}	Differential Measurement	0		125	ps	1

[1] Guaranteed by design and characterization, not 100% tested in production.

[2]Slew rate measured through Vswing min centered around differential zero

Electrical Characteristics - DIF 0.7V Current Mode Differential Pair

T_A = 0 - 70°C; V_{DD} = 3.3 V +/-5%; C_L =2pF, R_S=33Ω, R_P=49.9Ω, R_{REF}=475Ω

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Current Source Output Impedance	Zo^1		3000			Ω	1
Voltage High	VHigh	Statistical measurement on single ended signal using oscilloscope math function.	660		850	mV	1,2
Voltage Low	VLow		-150		150		1,2
Max Voltage	Vovs	Measurement on single ended signal using absolute value.			1150	mV	1
Min Voltage	Vuds		-300				1
Crossing Voltage (abs)	Vcross(abs)		250		550	mV	1
Crossing Voltage (var)	d-Vcross	Variation of crossing over all edges			140	mV	1
Rise Time	t_r	V_{OL} = 0.175V, V_{OH} = 0.525V	175		700	ps	1
Fall Time	t_f	V_{OH} = 0.525V V_{OL} = 0.175V	175		700	ps	1
Rise Time Variation	d-t_r				125	ps	1
Fall Time Variation	d-t_f				125	ps	1
Duty Cycle	d_{t3}	Measurement from differential wavefrom	45		55	%	1
Skew, Input to Output	t_{pdBYP}	Bypass Mode, V_T = 50%	2500		4500	ps	1
	t_{pdPLL}	PLL Mode V_T = 50%	-250		250	ps	1
Skew, Output to Output	t_{sk3}	V_T = 50%			50	ps	1
Jitter, Cycle to cycle	$t_{jcyc-cyc}$	PLL mode			50	ps	1,3
		Additive Jitter in Bypass Mode			50	ps	1,3
Jitter, Phase	$t_{jphaseBYP}$	PCIe Gen1 phase jitter (Additive in Bypass Mode)		7	10	ps (pk2pk)	1,4,5
		PCIe Gen 2 Low Band phase jitter (Additive in Bypass Mode)		0	0.1	ps (rms)	1,4,5
		PCIe Gen 2 High Band phase jitter (Additive in Bypass Mode)		0.7	0.9	ps (rms)	1,4,5
		QPI phase jitter (Additive in Bypass Mode)			0.16	ps (rms)	1,5,6
	$t_{jphasePLL}$	PCIe Gen 1 phase jitter		37	86	ps (pk2pk)	1,4,5
		PCIe Gen 2 Low Band phase jitter		1.5	3	ps (rms)	1,4,5
		PCIe Gen 2 High Band phase jitter		2.7/ 2.2	3.1	ps (rms)	1,4,5,7
		QPI phase jitter		0.28	0.5	ps (rms)	1,5,6

[1]Guaranteed by design and characterization, not 100% tested in production.

[2] $I_{REF} = V_{DD}/(3xR_R)$. For R_R = 475Ω (1%), I_{REF} = 2.32mA. I_{OH} = 6 x I_{REF} and V_{OH} = 0.7V @ Z_O=50Ω.

3 Measured from differential waveform

[4] See http://www.pcisig.com for complete specs

[5] Device driven by 932S421C or equivalent.

[6] 6.4Gb 12UI

[7] First number is High Bandwidth Mode, second number is Low Bandwidth Mode

Clock Periods Differential Outputs with Spread Spectrum Enabled

Measurement Window		1 Clock	1us	0.1s	0.1s	0.1s	1us	1 Clock		
Symbol		Lg-	-SSC	-ppm error	0ppm	+ ppm error	+SSC	Lg+		
Definition		Absolute Period	Short-term Average	Long-Term Average	Period	Long-Term Average	Short-term Average	Period		
		Minimum Absolute Period	Minimum Absolute Period	Minimum Absolute Period	Nominal	Maximum	Maximum	Maximum	Units	Notes
Signal Name	DIF 100	9.949	9.999	10.024	10.025	10.026	10.051	10.101	ns	1,2,3
	DIF 133	7.449	7.499	7.518	7.519	7.520	7.538	7.588	ns	1,2,4
	DIF 166	5.949	5.999	6.014	6.015	6.016	6.031	6.081	ns	1,2,5
	DIF 200	4.950	5.000	5.012	5.013	5.013	5.026	5.076	ns	1,2,5
	DIF 266	3.700	3.750	3.759	3.759	3.760	3.769	3.819	ns	1,2,5
	DIF 333	2.950	3.000	3.007	3.008	3.008	3.015	3.065	ns	1,2,5
	DIF 400	2.450	2.500	2.506	2.506	2.507	2.513	2.563	ns	1,2,5

Clock Periods Differential Outputs with Spread Spectrum Disabled

Measurement Window		1 Clock	1us	0.1s	0.1s	0.1s	1us	1 Clock		
Symbol		Lg-	-SSC	-ppm error	0ppm	+ ppm error	+SSC	Lg+		
Definition		Absolute Period	Short-term Average	Long-Term Average	Period	Long-Term Average	Short-term Average	Period		
		Minimum Absolute Period	Minimum Absolute Period	Minimum Absolute Period	Nominal	Maximum	Maximum	Maximum	Units	Notes
Signal Name	DIF 100	9.949		9.999	10.000	10.001		10.051	ns	1,2,3
	DIF 133	7.449		7.499	7.500	7.501		7.551	ns	1,2,4
	DIF 166	5.949		5.999	6.000	6.001		6.051	ns	1,2,5
	DIF 200	4.950		5.000	5.000	5.001		5.051	ns	1,2,5
	DIF 266	3.700		3.750	3.750	3.750		3.800	ns	1,2,5
	DIF 333	2.950		3.000	3.000	3.000		3.050	ns	1,2,5
	DIF 400	2.450		2.500	2.500	2.500		2.550	ns	1,2,5

[1]Guaranteed by design and characterization, not 100% tested in production.

[2] All Long Term Accuracy specifications are guaranteed with the assumption that the input clock complies with CK410B+ accuracy requirements. The 9DB423/823 itself does not contribute to ppm error.

[3] Driven by SRC output of main clock, PCIe PLL Mode or Bypass mode

[4] Driven by CPU output of main clock, QPI PLL Mode or Bypass mode

[5] Driven by CPU output of CK410B+/CK420BQ/CK505 main clock, **Bypass mode only**

Output Termination & Layout Information			
Common Recommendations for Differential Routing	Dimension or Value	Unit	Figure
L1 length, Route as non-coupled 50 ohm trace.	0.5 max	inch	1
L2 length, Route as non-coupled 50 ohm trace.	0.2 max	inch	1
L3 length, Route as non-coupled 50 ohm trace.	0.2 max	inch	1
Rs	33	ohm	1
Rt	49.9	ohm	1

Down Device Differential Routing	Dimension or Value	Unit	Figure
L4 length, Route as coupled **microstrip** 100 ohm differential trace.	2 min to 16 max	inch	1
L4 length, Route as coupled **stripline** 100 ohm differential trace.	1.8 min to 14.4 max	inch	1

Differential Routing to PCI Express Connector	Dimension or Value	Unit	Figure
L4 length, Route as coupled **microstrip** 100 ohm differential trace.	0.25 to 14 max	inch	2
L4 length, Route as coupled **stripline** 100 ohm differential trace.	0.225 min to 12.6 max	inch	2

Figure 1. Down Device Differential Routing

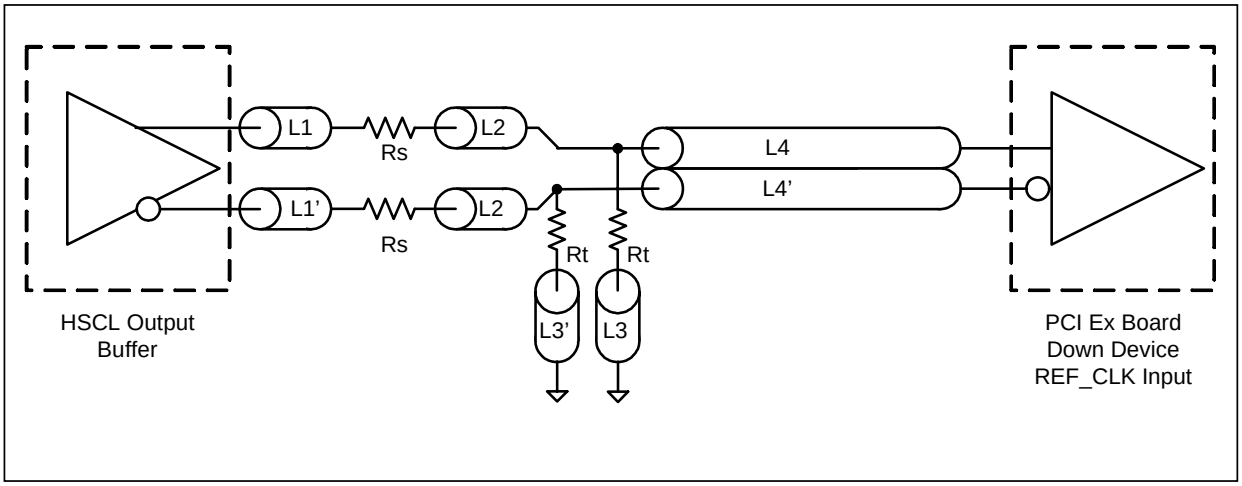


Figure 2. Differential Routing to PCI Express Controller

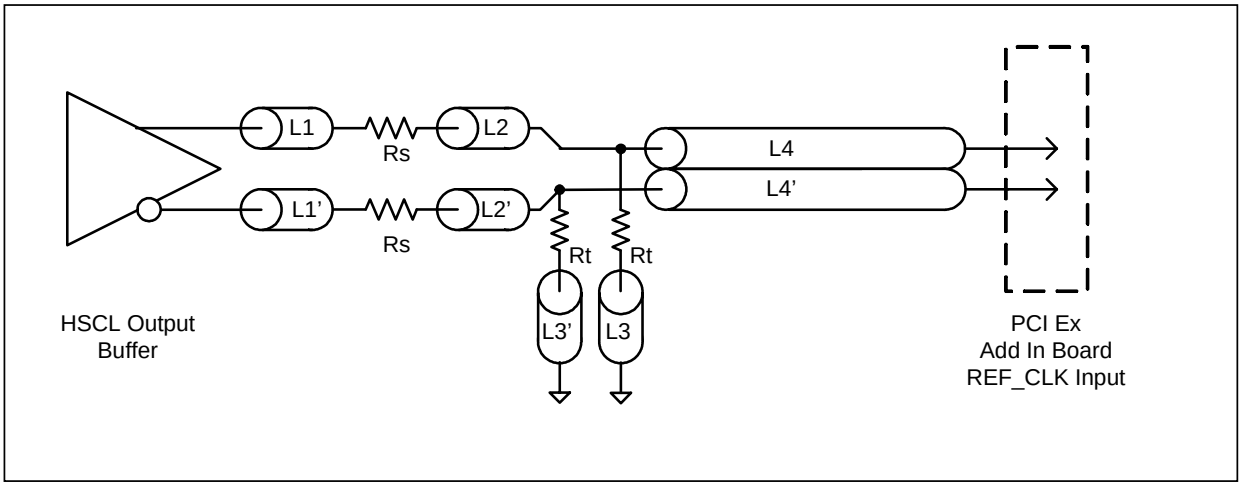
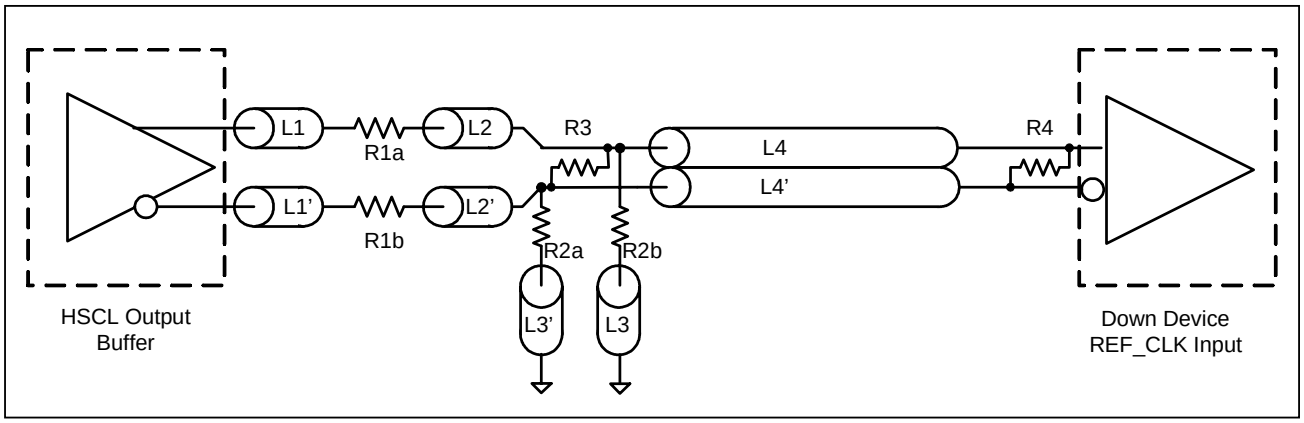


Figure 3. Terminations for LVDS and other common differential signals.

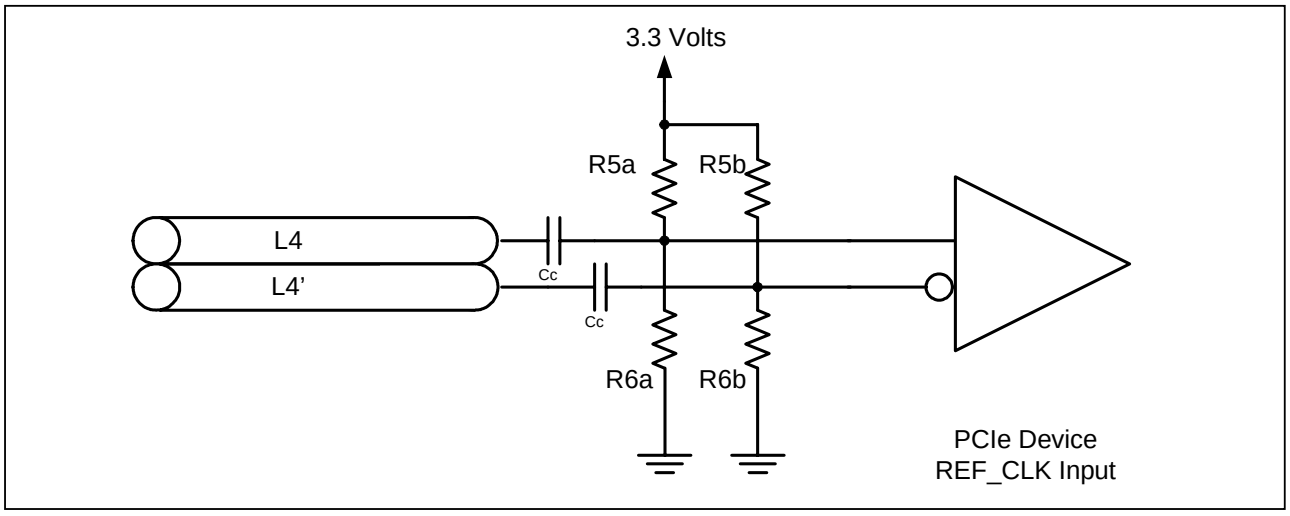


R2a = R2b = R2

Vdiff	Vp-p	Vcm	R1	R2	R3	R4	Note
0.45 v	0.22v	1.08	33	150	100	100	
0.58	0.28	0.6	33	78.7	137	100	
0.80	0.40	0.6	33	78.7	none	100	ICS874003i-02 input compatible
0.60	0.3	1.2	33	174	140	100	Standard LVDS

R1a = R1b = R1

Figure 4. Terminations for cable AC coupled applications



Component	Value	Note
R5a,R5b	8.2K 5%	
R6a,R6b	1K 5%	
Cc	0.1 uF	
Vcm	0.350 volts	

General SMBus serial interface information for the ICS9DB423B

How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address $DC_{(h)}$
- ICS clock will ***acknowledge***
- Controller (host) sends the beginning byte location = N
- ICS clock will ***acknowledge***
- Controller (host) sends the data byte count = X
- ICS clock will ***acknowledge***
- Controller (host) starts sending ***Byte N through Byte N + X -1***
- ICS clock will ***acknowledge*** each byte ***one at a time***
- Controller (host) sends a Stop bit

How to Read:

- Controller (host) will send start bit.
- Controller (host) sends the write address $DC_{(h)}$
- ICS clock will ***acknowledge***
- Controller (host) sends the begining byte location = N
- ICS clock will ***acknowledge***
- Controller (host) will send a separate start bit.
- Controller (host) sends the read address $DD_{(h)}$
- ICS clock will ***acknowledge***
- ICS clock will send the data byte count = X
- ICS clock sends ***Byte N + X -1***
- ICS clock sends ***Byte 0 through byte X (if $X_{(h)}$ was written to byte 8)***.
- Controller (host) will need to acknowledge each byte
- Controller (host) will send a not acknowledge bit
- Controller (host) will send a stop bit

Index Block Write Operation

Controller (Host)			ICS (Slave/Receiver)
T	starT bit		
Slave Address $DC_{(h)}$			
WR	WRite		
			ACK
Beginning Byte = N			
			ACK
Data Byte Count = X			
			ACK
Beginning Byte N		X Byte	
			ACK
◇			
◇			◇
◇			◇
			◇
Byte N + X - 1			
			ACK
P	stoP bit		

Index Block Read Operation

Controller (Host)		ICS (Slave/Receiver)	
T	starT bit		
Slave Address $DC_{(h)}$			
WR	WRite		
			ACK
Beginning Byte = N			
			ACK
RT	Repeat starT		
Slave Address $DD_{(h)}$			
RD	ReaD		
			ACK
			Data Byte Count = X
ACK			
		X Byte	Beginning Byte N
ACK			
			◇
◇			◇
◇			◇
◇			
			Byte N + X - 1
N	Not acknowledge		
P	stoP bit		

SMBus Table: Frequency Select Register, READ/WRITE ADDRESS (DC/DD)

Byte 0	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	PD_Mode	PD# drive mode	RW	driven	Hi-Z	0
Bit 6	-	STOP_Mode	DIF_Stop# drive mode	RW	driven	Hi-Z	0
Bit 5	-	PD_Polarity	Select PD polarity	RW	Low	High	0
Bit 4	-	Reserved					X
Bit 3	-	BYPASS#1	BYPASS#/PLL1	RW	See Bypass Readback Table		Input
Bit 2	-	PLL_BW#	Select PLL BW	RW	High BW	Low BW	1
Bit 1	-	BYPASS#0	BYPASS#/PLL0	RW	See Bypass Readback Table		Input
Bit 0	-	SRC_DIV#	SRC Divide by 2 Select	RW	x/2	x/1	1

SMBus Table: Output Control Register

Byte 1	Pin #	Name	Control Function	Type	0	1	Default
Bit 7		Reserved					1
Bit 6	22,23	DIF_6	Output Enable	RW	Disable	Enable	1
Bit 5	19,20	DIF_5	Output Enable	RW	Disable	Enable	1
Bit 4		Reserved					1
Bit 3		Reserved					1
Bit 2	9,10	DIF_2	Output Enable	RW	Disable	Enable	1
Bit 1	6,7	DIF_1	Output Enable	RW	Disable	Enable	1
Bit 0		Reserved					1

NOTE: The SMBus Output Enable Bit must be '1' AND the respective OE pin must be active for the output to run!

SMBus Table: OE Pin Control Register

Byte 2	Pin #	Name	Control Function	Type	0	1	Default
Bit 7		Reserved					0
Bit 6	22,23	DIF_6	DIF_6 Stoppable with OE6	RW	Free-run	Stoppable	0
Bit 5		Reserved					0
Bit 4		Reserved					0
Bit 3		Reserved					0
Bit 2		Reserved					0
Bit 1	6,7	DIF_1	DIF_1 Stoppable with OE1	RW	Free-run	Stoppable	0
Bit 0		Reserved					0

SMBus Table: Reserved Register

Byte 3	Pin #	Name	Control Function	Type	0	1	Default
Bit 7		Reserved					X
Bit 6		Reserved					X
Bit 5		Reserved					X
Bit 4		Reserved					X
Bit 3		Reserved					X
Bit 2		Reserved					X
Bit 1		Reserved					X
Bit 0		Reserved					X

SMBus Table: Vendor & Revision ID Register

Byte 4	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	RID3	REVISION ID	R	-	-	0
Bit 6	-	RID2		R	-	-	0
Bit 5	-	RID1		R	-	-	0
Bit 4	-	RID0		R	-	-	1
Bit 3	-	VID3	VENDOR ID	R	-	-	0
Bit 2	-	VID2		R	-	-	0
Bit 1	-	VID1		R	-	-	0
Bit 0	-	VID0		R	-	-	1

SMBus Table: DEVICE ID

Byte 5	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	Device ID 7 (MSB)		R	Device ID is 42 Hex for 9DB423		0
Bit 6	-	Device ID 6		R			1
Bit 5	-	Device ID 5		R			0
Bit 4	-	Device ID 4		R			0
Bit 3	-	Device ID 3		R			0
Bit 2	-	Device ID 2		R			0
Bit 1	-	Device ID 1		R			1
Bit 0	-	Device ID 0		R			0

SMBus Table: Byte Count Register

Byte 6	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	BC7	Writing to this register configures how many bytes will be read back.	RW	-	-	0
Bit 6	-	BC6		RW	-	-	0
Bit 5	-	BC5		RW	-	-	0
Bit 4	-	BC4		RW	-	-	0
Bit 3	-	BC3		RW	-	-	0
Bit 2	-	BC2		RW	-	-	1
Bit 1	-	BC1		RW	-	-	1
Bit 0	-	BC0		RW	-	-	1

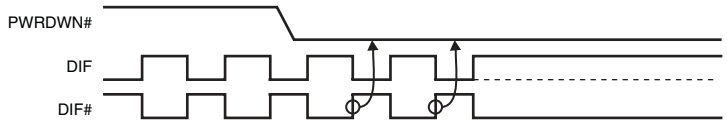
Note: Polarities in timing diagrams are shown OE_INV = 0. They are similar to OE_INV = 1.

PD#, Power Down

The PD# pin cleanly shuts off all clocks and places the device into a power saving mode. PD# must be asserted before shutting off the input clock or power to insure an orderly shutdown. PD is asynchronous active-low input for both powering down the device and powering up the device. When PD# is asserted, all clocks will be driven high, or tri-stated (depending on the PD# drive mode and Output control bits) before the PLL is shut down.

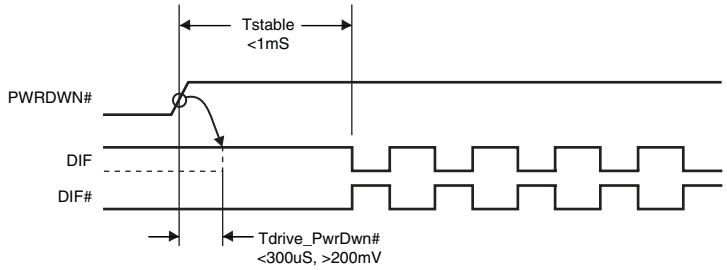
PD# Assertion

When PD# is sampled low by two consecutive rising edges of DIF#, all DIF outputs must be held High, or tri-stated (depending on the PD# drive mode and Output control bits) on the next High-Low transition of the DIF# outputs. When the PD# drive mode bit is set to '0', all clock outputs will be held with DIF driven High with 2 x I_{REF} and DIF# tri-stated. If the PD# drive mode bit is set to '1', both DIF and DIF# are tri-stated.



PD# De-assertion

Power-up latency is less than 1 ms. This is the time from de-assertion of the PD# pin, or VDD reaching 3.3V, or the time from valid SRC_IN clocks until the time that stable clocks are output from the device (PLL Locked). If the PD# drive mode bit is set to '1', all the DIF outputs must driven to a voltage of >200 mV within 300 us of PD# de-assertion.



DIF_STOP#

The DIF_STOP# signal is an active-low asynchronous input that cleanly stops and starts the DIF outputs. A valid clock must be present on SRC_IN for this input to work properly. The DIF_STOP# signal is de-bounced and must remain stable for two consecutive rising edges of DIF# to be recognized as a valid assertion or de-assertion.

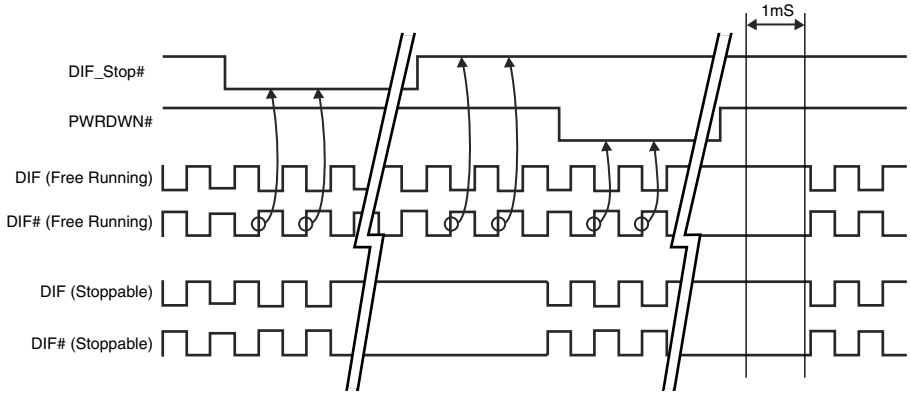
DIF_STOP# - Assertion

Asserting DIF_STOP# causes all DIF outputs to stop after their next transition (if the control register settings allow the output to stop). When the DIF_STOP# drive bit is '0', the final state of all stopped DIF outputs is DIF = High and DIF# = Low. There is no change in output drive current. DIF is driven with $6xI_{REF}$. DIF# is not driven, but pulled low by the termination. When the DIF_STOP# drive bit is '1', the final state of all DIF output pins is Low. Both DIF and DIF# are not driven.

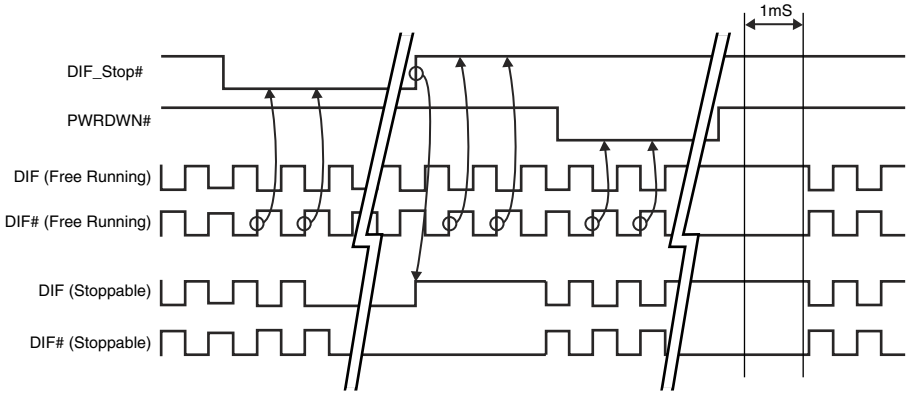
DIF_STOP# - De-assertion (transition from '0' to '1')

All stopped differential outputs resume normal operation in a glitch-free manner. The de-assertion latency to active outputs is 2-6 DIF clock periods, with all DIF outputs resuming simultaneously. If the DIF_STOP# drive control bit is '1' (tri-state), all stopped DIF outputs must be driven High (>200 mV) within 10 ns of de-assertion.

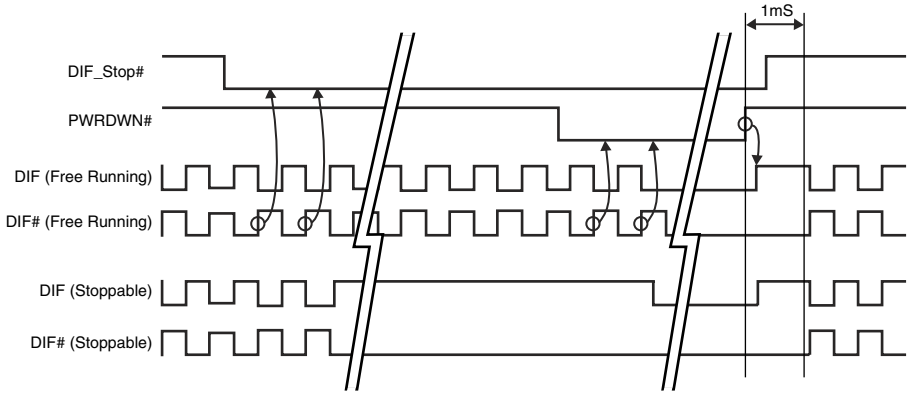
DIF_STOP_1 (Stop_Mode = Driven, PD_Mode = Driven)



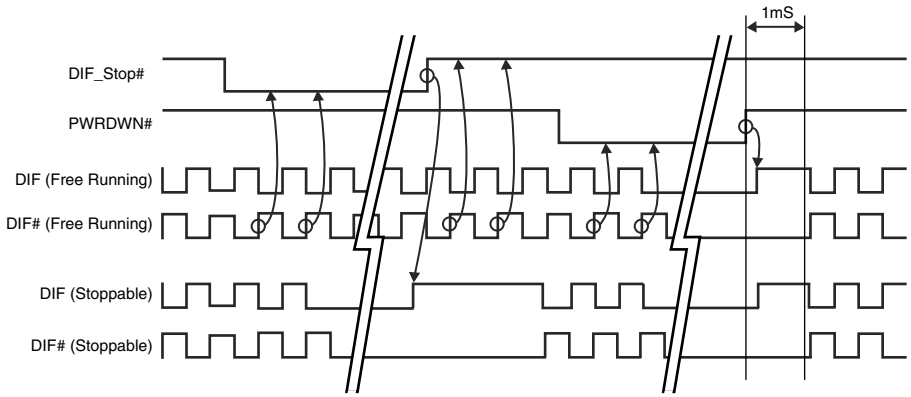
DIF_STOP_2 (Stop_Mode = Tristate, PD_Mode = Driven)

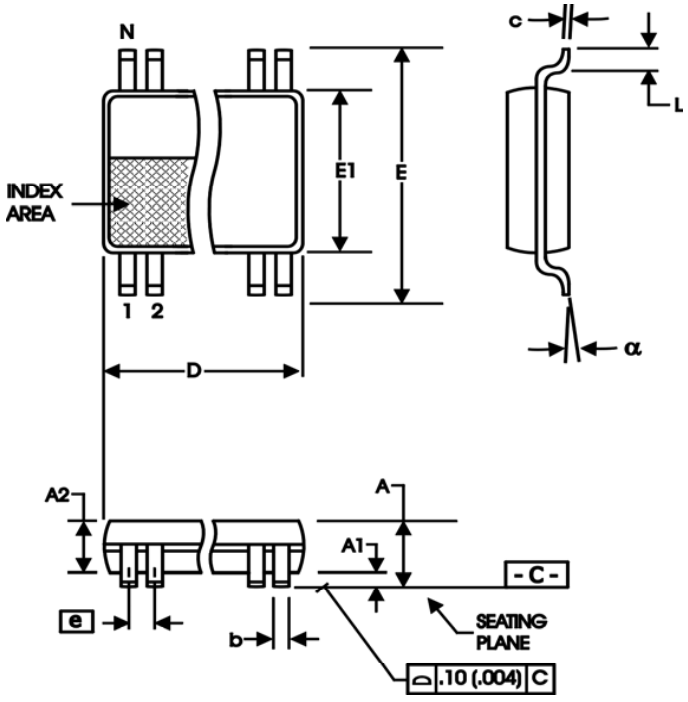


DIF_STOP_3 (Stop_Mode = Driven, PD_Mode = Tristate)



DIF_STOP_4 (Stop_Mode = Tristate, PD_Mode = Tristate)





209 mil SSOP

209 mil SSOP

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	--	2.00	--	.079
A1	0.05	--	.002	--
A2	1.65	1.85	.065	.073
b	0.22	0.38	.009	.015
c	0.09	0.25	.0035	.010
D	SEE VARIATIONS		SEE VARIATIONS	
E	7.40	8.20	.291	.323
E1	5.00	5.60	.197	.220
e	0.65 BASIC		0.0256 BASIC	
L	0.55	0.95	.022	.037
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°

VARIATIONS

N	D mm.		D (inch)	
	MIN	MAX	MIN	MAX
28	9.90	10.50	.390	.413

Reference Doc.: JEDEC Publication 95, MO-150

10-0033

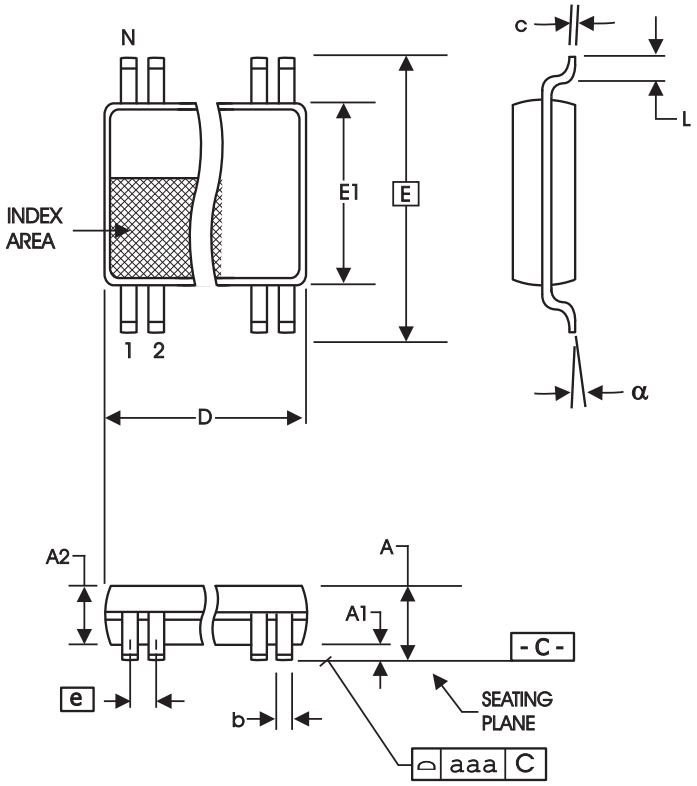
Ordering Information

ICS9DB423BFLFT

Example:

ICS XXXX B F LF T

- **Designation for tape and reel packaging**
- **Lead Free, RoHS Compliant**
- **Package Type**
  F = SSOP
- **Revision Designator**
- **Device Type (consists of 3 to 7 digit numbers)**
- **Prefix**
  ICS (not part of the orderable part number)



4.40 mm. Body, 0.65 mm. Pitch TSSOP

(173 mil) (25.6 mil)

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	--	1.20	--	.047
A1	0.05	0.15	.002	.006
A2	0.80	1.05	.032	.041
b	0.19	0.30	.007	.012
c	0.09	0.20	.0035	.008
D	SEE VARIATIONS		SEE VARIATIONS	
E	6.40 BASIC		0.252 BASIC	
E1	4.30	4.50	.169	.177
e	0.65 BASIC		0.0256 BASIC	
L	0.45	0.75	.018	.030
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°
aaa	--	0.10	--	.004

VARIATIONS

N	D mm.		D (inch)	
	MIN	MAX	MIN	MAX
28	9.60	9.80	.378	.386

Reference Doc.: JEDEC Publication 95, MO-153

10-0035

Ordering Information

ICS9DB423BGLFT

Example:

ICS XXXX B G LF T

Designation for tape and reel packaging
Lead Free, RoHS Compliant
Package Type
G = TSSOP
Revision Designator
Device Type (consists of 3 to 7 digit numbers)
Prefix
ICS (not part of the orderable part number)

Revision History

Rev.	Issue Date	Description	Page #
A	9/30/2008	1. Updated Electrical Characteristics to add propagation delay and phase noise information. 2. Corrected SMBus to reference pin numbers for 423 instead of 823 device. 3. Removed references to OE controls that are not present on 423. 4. Added SMBus electrical characteristics 5. Added foot note about DIF input running in order for the SMBus interface to work 6. Added foot note to Byte 1 about functionality of OE bits and OE pins. 7. Corrected Block Diagram with proper OE pins indicated and PD and DIF_STOP# pins added 8. Updated clock periods to reflect +/-100ppm input clock tolerance (CK410B+/CK420BQ/CK505). 9. Changed SRC_Stop references to DIF_Stop references for consistency.	Various